Report of Red Snapper Otolith Aging; 2000 Data Summary

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Introduction

In the year 2000 6,877 red snapper otoliths were collected during 516 separate sampling sessions. Red snapper were sampled from the Gulf of Mexico every month of the year. Collection sites ranged from Texas to the west coast of Florida. The majority of samples were collected by 25 port agents from three sampling programs: the trip interview program (TIP) (91%), the Beaufort headboat program (6%) and the National Marine Fisheries Service (NMFS) fishery independent survey (3%) (Fig. 1a). The NMFS fishery-independent survey included a hook and line survey conducted by the Panama City laboratory and a long-line survey conducted by the Pascagoula, Mississippi laboratory. The marine recreational fisheries statistical survey (MRFSS) accounted for less than 1% of otoliths sampled.

Otolith collections totals from the eastern gulf (Florida, Alabama and Mississippi) were approximately equal to those from the western Gulf of Mexico (Louisiana and Texas). The largest percentage of red snapper otoliths came from Louisiana (43%) followed by Florida (37%), Mississippi (13%), Alabama (4%) and Texas (3%) (Fig. 1b). The fishing mode recorded most frequently was commercial hand-line (76%) (Fig.1c). Charter boat catches were next in frequency with 8% of the total. Commercial long-line and head boat catches were 7% and 6% respectively. Fishery-independent surveys represented about 3% of the total catch and no private boat recreational landings were sampled in 2000. This report provides a summary of results of the age frequency and size and age distributions of red snapper by fishing mode and sampling region.

Size frequencies

Length frequency distributions were generated for all red snapper sampled and we noted differences in length distributions by fishing mode and sampling region. The commercial long-line provided the greatest percentage of large individuals from the fishery-dependent landings with a mode in the 700-750 mm total length (TL) size class (Fig. 2). The commercial hook and line, charter boat and head boat size distributions were similar, all with modes in the 400-450 mm TL size class. The size distribution for the fishery-independent long-line survey indicated a similar distribution to the commercial long-line distribution with a mode in the 751-799 size class (Fig. 3). The fishery-independent hook and line survey consisted of the smallest individuals with over 40% of the individuals 350 mm TL or less.

Length frequency distributions were also compared between western gulf (LA and TX) and eastern gulf (FL, AL and MS). The commercial hook and line fishery had very similar size distributions between east and west with the 400-450 mm TL size class making up about 30% of the landings in each region (Fig.4). The size distribution between east and west long-line landings was notably different with a mode in the 700-750 mm size class for the western gulf and 600-650 mm for the eastern gulf. However, the eastern gulf provided a higher proportion of red snapper greater than 800 mm TL. The recreational fishery (charter and head boat combined) from the eastern and western gulf both had modes in 400-450 mm TL size class with the western gulf composed of a higher proportion of fish beyond 550 mm TL (Fig. 5). The fishery-independent hook and line survey was conducted in the Eastern Gulf of Mexico, while the fishery-independent long-line survey was conducted in Texas waters (Mitchell 2000).

Subsample for Age Composition

A sub-sample was selected for sectioning and annual age determination. Of the 6,877 red snapper otoliths sampled, 3,688 (54%) were selected to be sectioned and aged. Our subsample of otoliths was based on stratified random draws of collections rather than individual fish records because of the time required to enter, update and proof individual fish records. This random sub-sample was stratified by selecting approximately 50% of the samples from the western gulf and 50% of the samples from the eastern gulf. In addition, we attempted to get good representation from all fishing sectors. Unfortunately, few recreational samples were collected during 2000, consequently all recreational sector otoliths collected were selected for age determination. The results of our subsample included 73% of the otoliths from the commercial sector and 27% from the recreational sector (Fig. 6a). Approximately 53% of the samples were drawn from eastern gulf states (FL, AL and MS) and 47% from western gulf states (LA and TX) (Fig. 6b). Florida and Louisiana made up the bulk of the collections (39% and 43% respectively), followed by Mississippi (8%) and Texas (5%) and Alabama (5%) (Fig. 6c).

We followed the processing method of Cowan et al. (1995). The sectioned otoliths were assigned an age based on the count of annuli (opaque zones observed with transmitted light) and the degree of marginal edge completion. For example, otoliths were advanced a year in age after January 1st if their edge-type was a nearly complete translucent zone. Typically, marine fish in the southeastern U.S. complete annulus formation (opaque zone formation) by late-spring to early summer. Therefore an otolith with two completed annuli and a large translucent zone would be classified as age 3 if the fish was caught during spring in expectation that a 3rd (opaque) annulus would have soon formed. After June 30, when opaque zone formation is typically complete, all fish were assigned an age equal to the annulus count by convention. By this traditional method, an annual age cohort is based on a calender year rather than time since spawning (Jearld 1983).

Calibration and Quality Control of Aging

The production aging of red snapper at the Panama City Laboratory involved 3 readers due to the volume of samples. Readers made independent age determinations of otolith sections that were randomly selected for ageing. Twenty percent of otoliths aged were read by all readers for calibration and error determination. All three readers showed greater than 96% agreement for "1 year and 99% or higher for " 2 years (Table 1). The average percent error (APE; Beamish and Fournier 1981) for all red snapper aged was 3.9%. Due to poor preparation or difficultly distinguishing annuli, 3.6% of the sectioned otoliths were rejected.

2000 Age distributions by Fishing Sector and Region

Red snapper collected in 2000 ranged in age from 1 to 57 years. The age at recruitment to the commercial hook and line, charter boat and head boat fisheries was age-3, while peak recruitment to the commercial long-line gear occurred about age-5 (Fig.7). The fishery-

independent scientific survey indicated that fish recruited to hook and line gear at age-3, while recruitment to the survey long-line gear occurred by age 7 or 8 (Fig.8).

Size at age data reflected this trend indicating that larger and older fish were most common in the commercial long-line landings (Fig. 9). The commercial long-line fishery accounted for the oldest largest individuals with 14% greater than 12 years. The commercial hook and line, and recreational fishery landings had a similar size and age structure with few fish beyond 10 years. The hook and line fishery-independent survey consisted of the smallest and youngest fish with no individuals greater than 6 years (Fig.10). The long-line portion of the scientific survey was consistent with the commercial long-line fishery with 26% of the fish greater than 12 years.

The age structure of the commercial hook and line fishery was very similar between east and west with 3 and 4 year olds making up over 60% of each regions catch (Fig.11). In contrast, the commercial long-line fishery in the eastern gulf was composed of older individuals compared to the western gulf with 37% 10 years or greater compared to 17% for the western gulf. This reflects the nearly bimodal length pattern seen for the eastern gulf long-line samples. However, the western gulf long-line size and age modes were larger. Differences were also noted for the recreational fishery. Fifty-five percent of the recreational landing in the eastern gulf were composed of 3 year olds and only 7% were 5 years or greater, compared to the western gulf where 36% of individuals were 5 years or greater (Fig.12).

Future work

In anticipation of a 2004 red snapper stock assessment, greater effort is needed from the recreational fishery by state and/or federal port samplers. In addition, a concentrated effort to sample red snapper from the western Gulf of Mexico (i.e., Texas landings) would be beneficial. Further questions remain concerning the timing and position of first annulus formation. Future plans include rearing and chemically marking known age-0 red snapper to elucidate the timing and placement of the first annulus on the sagittae.

References

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Mitchell, K.M. 2000. Report of NOAA ship Gordon Gunter cruise GU-00-03. Mississippi Laboratories, Pascagoula, MS. 9 pgs.

Acknowledgments

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Table 1. The frequencies with which the age assigned by one reader differed from the age assigned by another reader for the 20% of the subsample of otoliths which were read by all readers. The average percent error (APE) for all readers was 3.9%.

Age Difference	Reader 1 vs 2	Reader 1 vs 3	Reader 2 vs 3
-5	0	1	2
-4	0	1	0
-3	0	3	1
-2	6	9	12
-1	57	80	84
0	495	470	458
1	52	45	49
2	3	6	9
3	2	0	0
4	0	0	0
5	0	0	0
Percent agreement within " 1	98.2%	96.8%	96.1%
Percent agreement within " 2	99.7%	99.2%	99.5%

Figure 1. Percent composition of total 2000 red snapper otolith collection (n= 6,876) by program source a), state b) and fishing mode c).

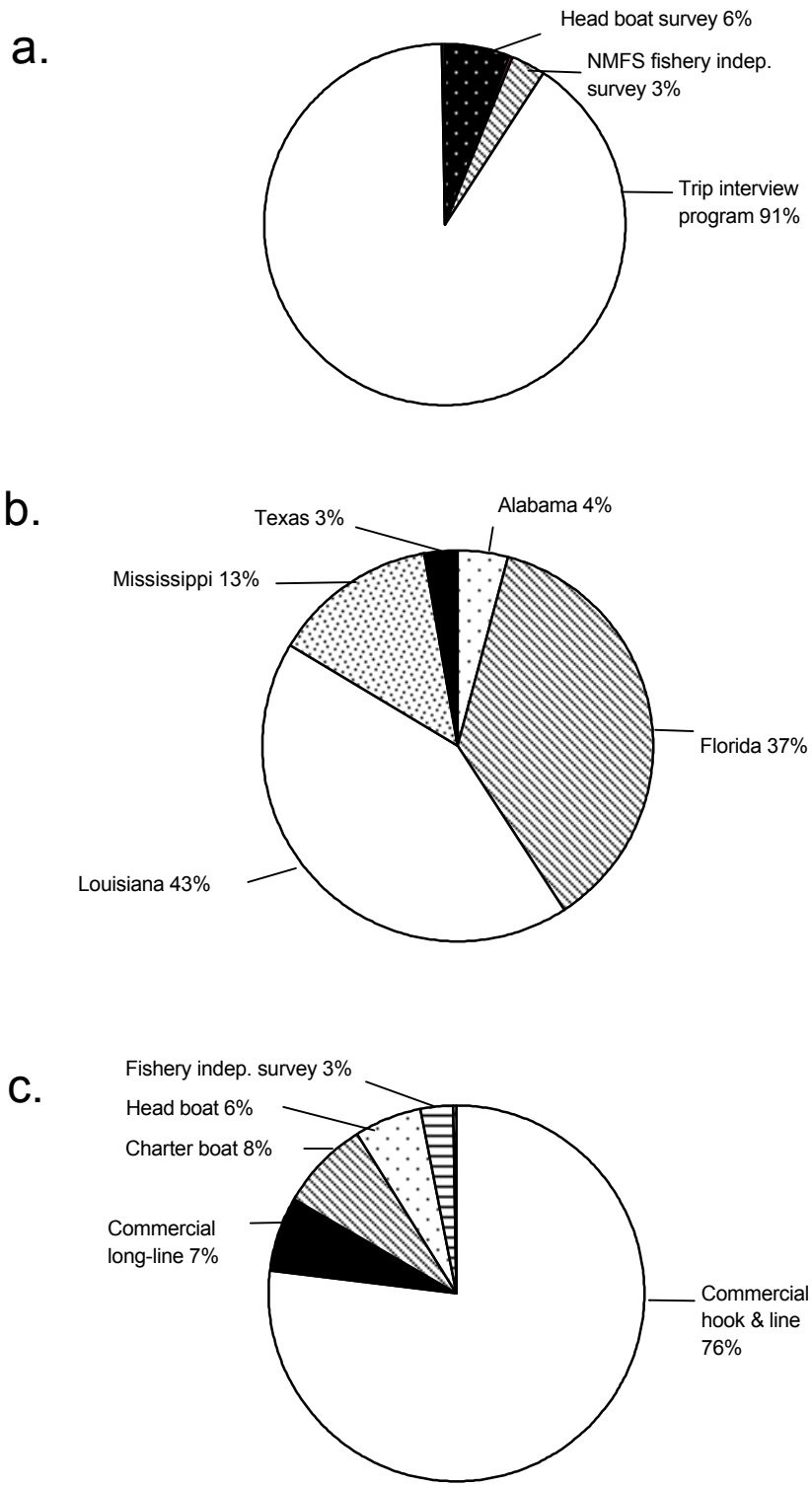
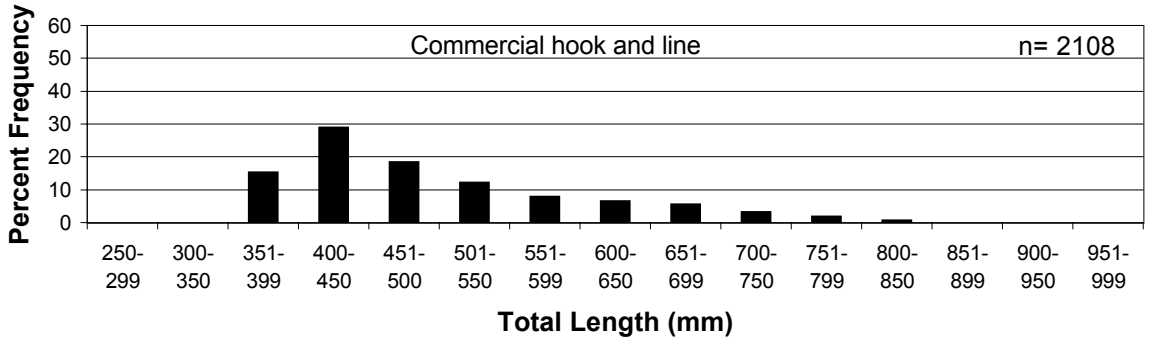
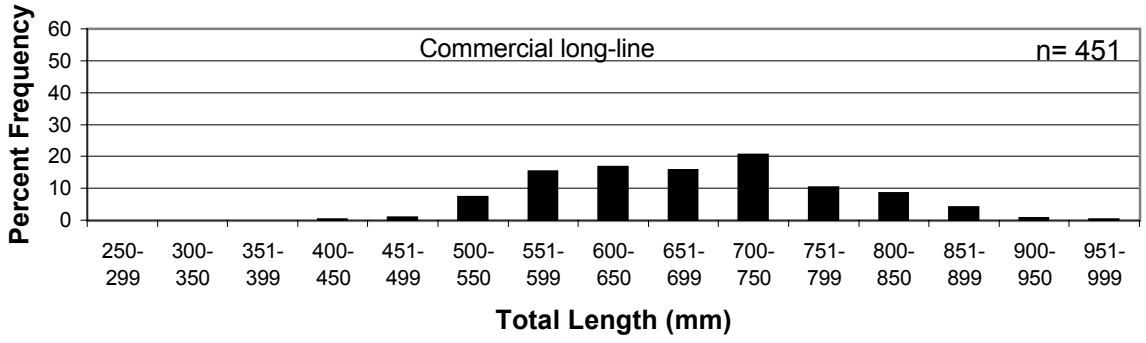
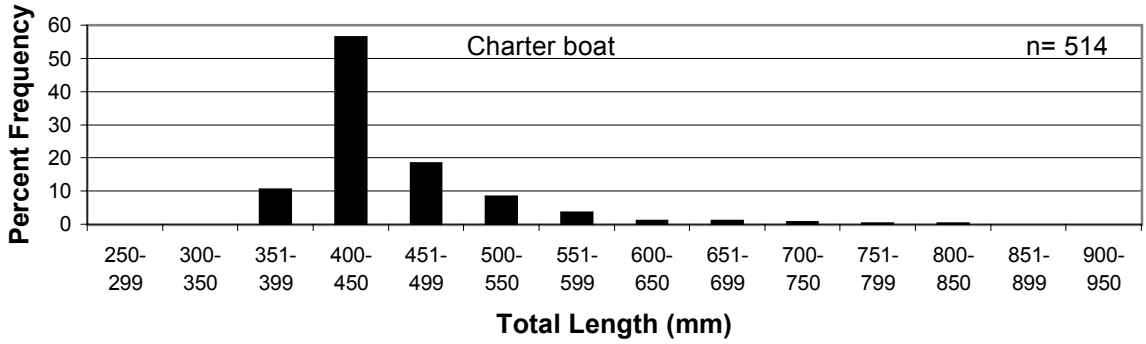


Figure 2. Size frequency of red snapper sampled for otoliths from the commercial and recreational fishery.







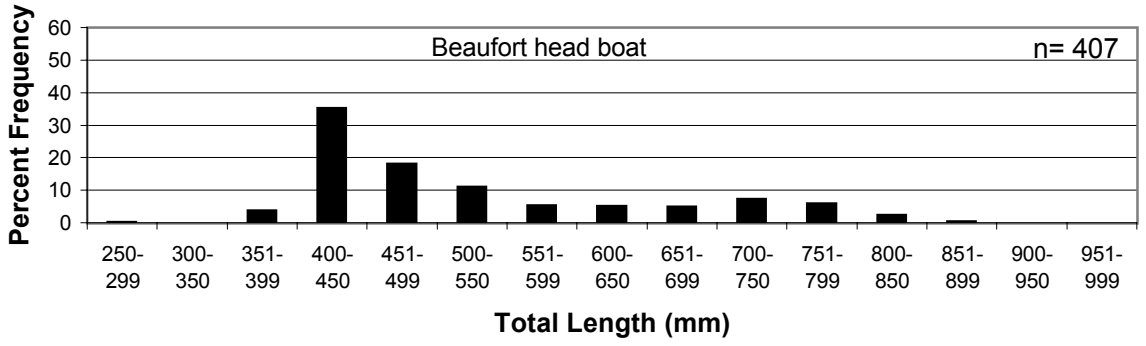
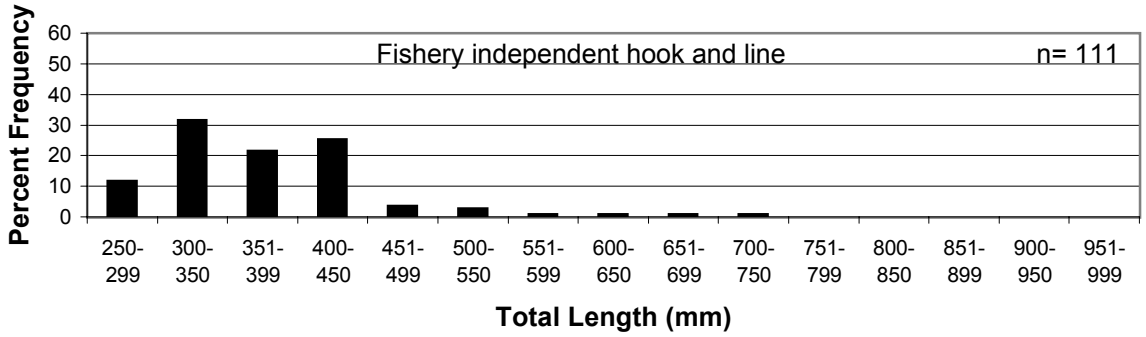


Figure 3. Size frequency of red snapper sampled for otoliths from fishery independent surveys



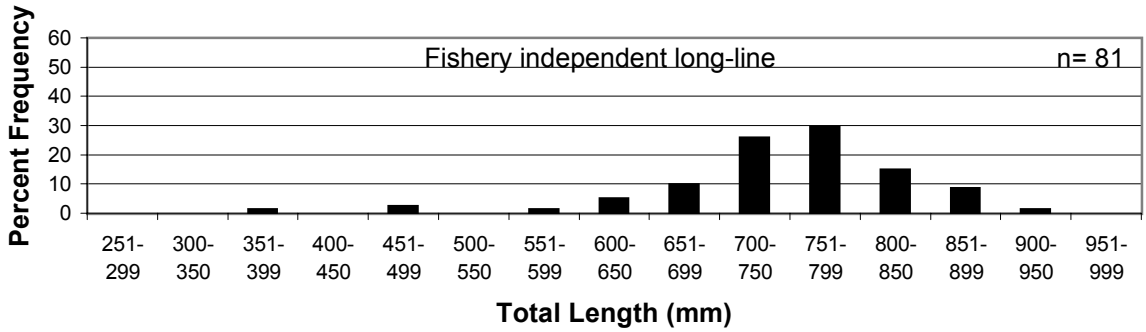


Figure 4. Size frequency of red snapper sampled for otoliths by region for the commercial and recreational fishery.

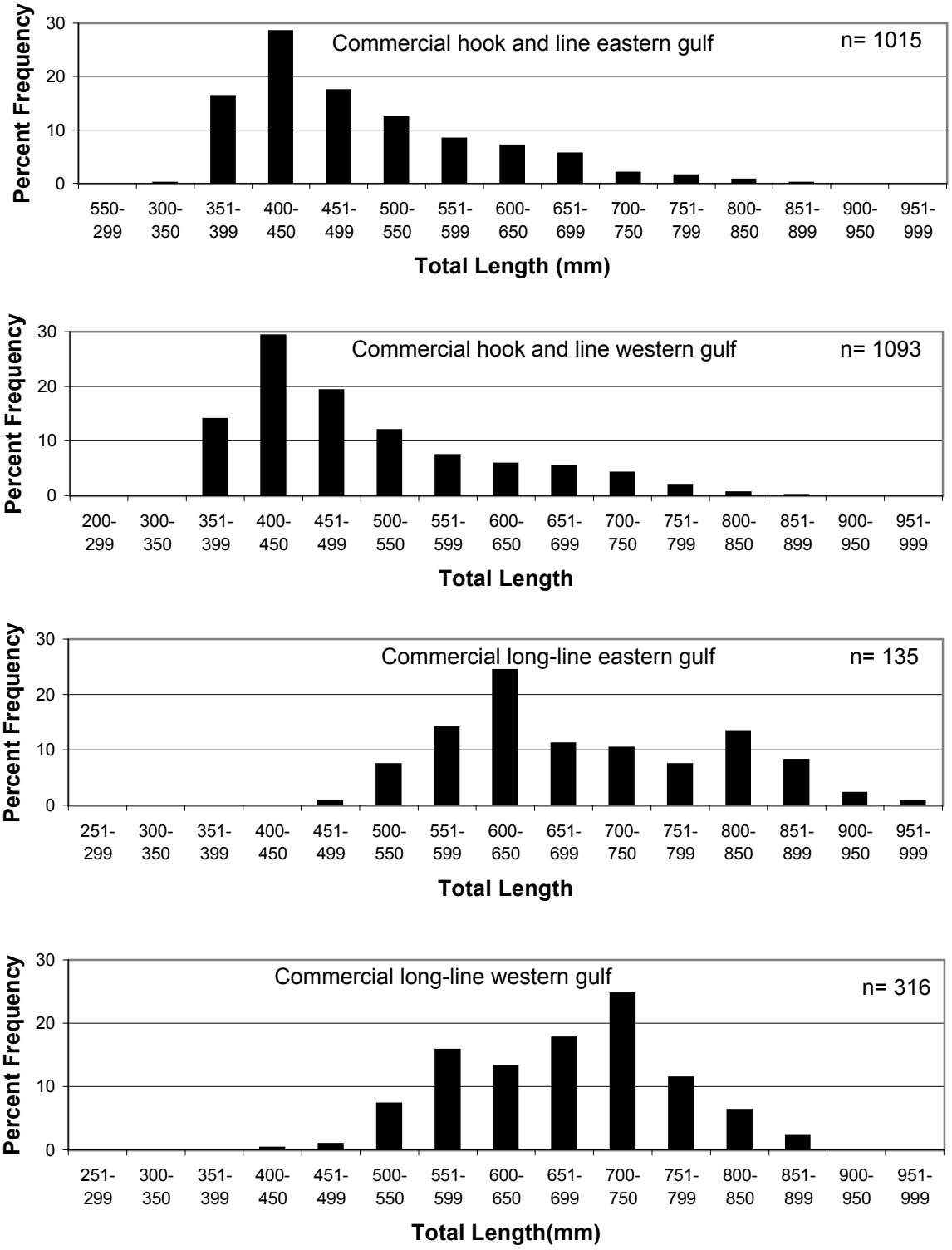
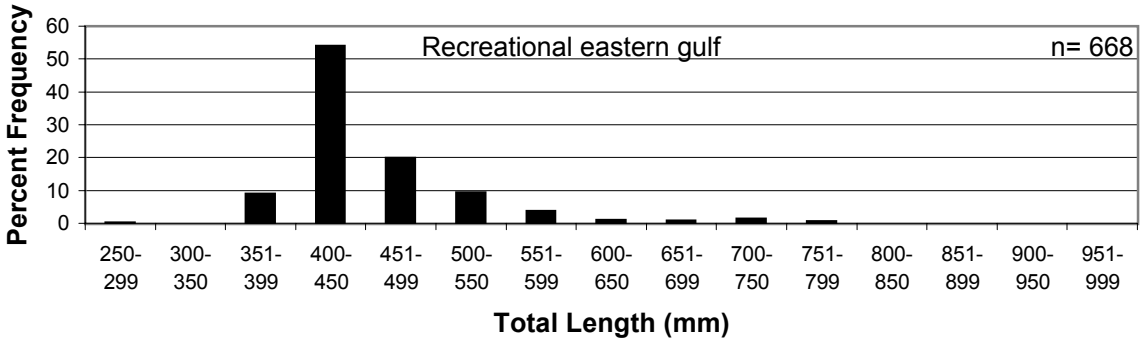


Figure 5. Size frequency of red snapper sampled for otoliths by region for the recreational fishery.



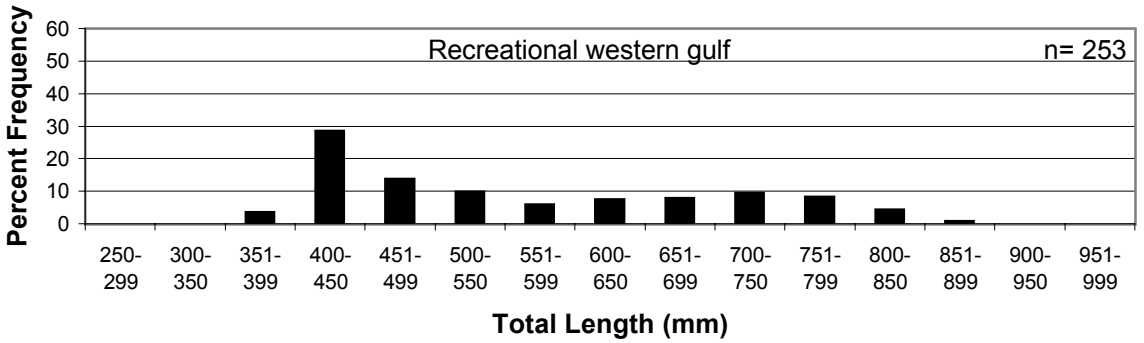


Figure 6. Composition of subsample selected for age determination by fishing sector a), region b) and state c) (n= 3,688).

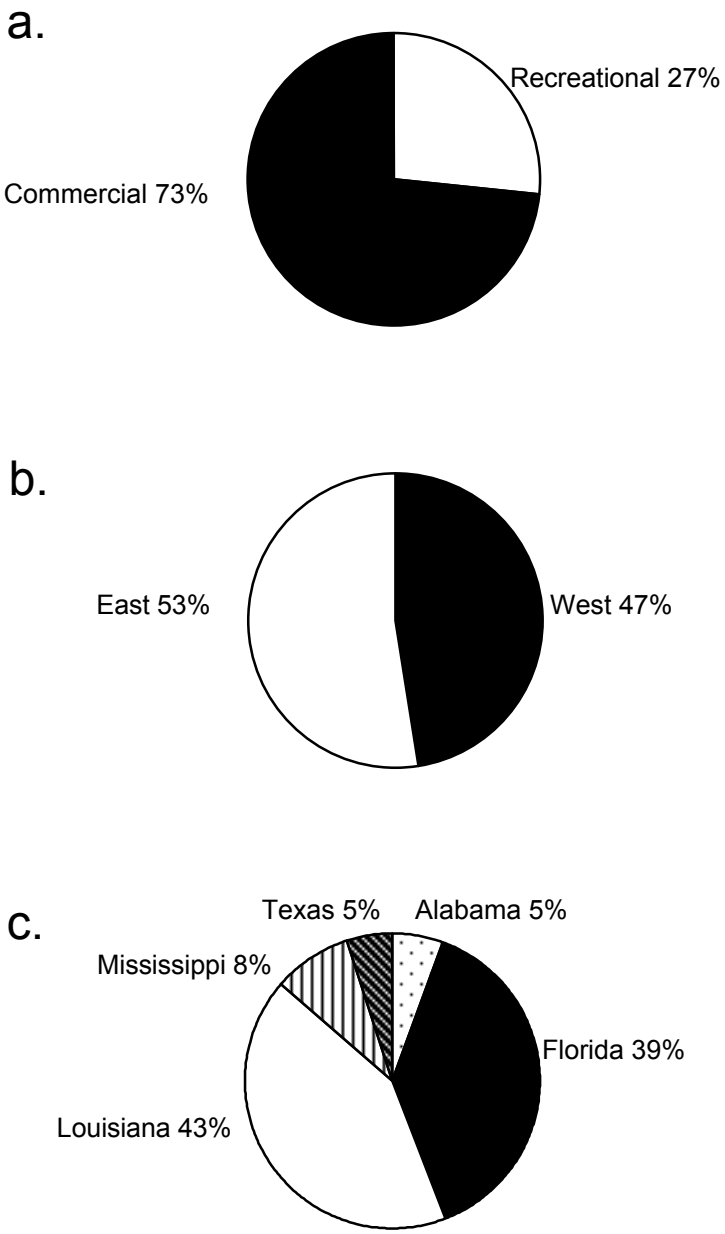


Figure 7. Age frequency distribution for red snapper by fishing mode.

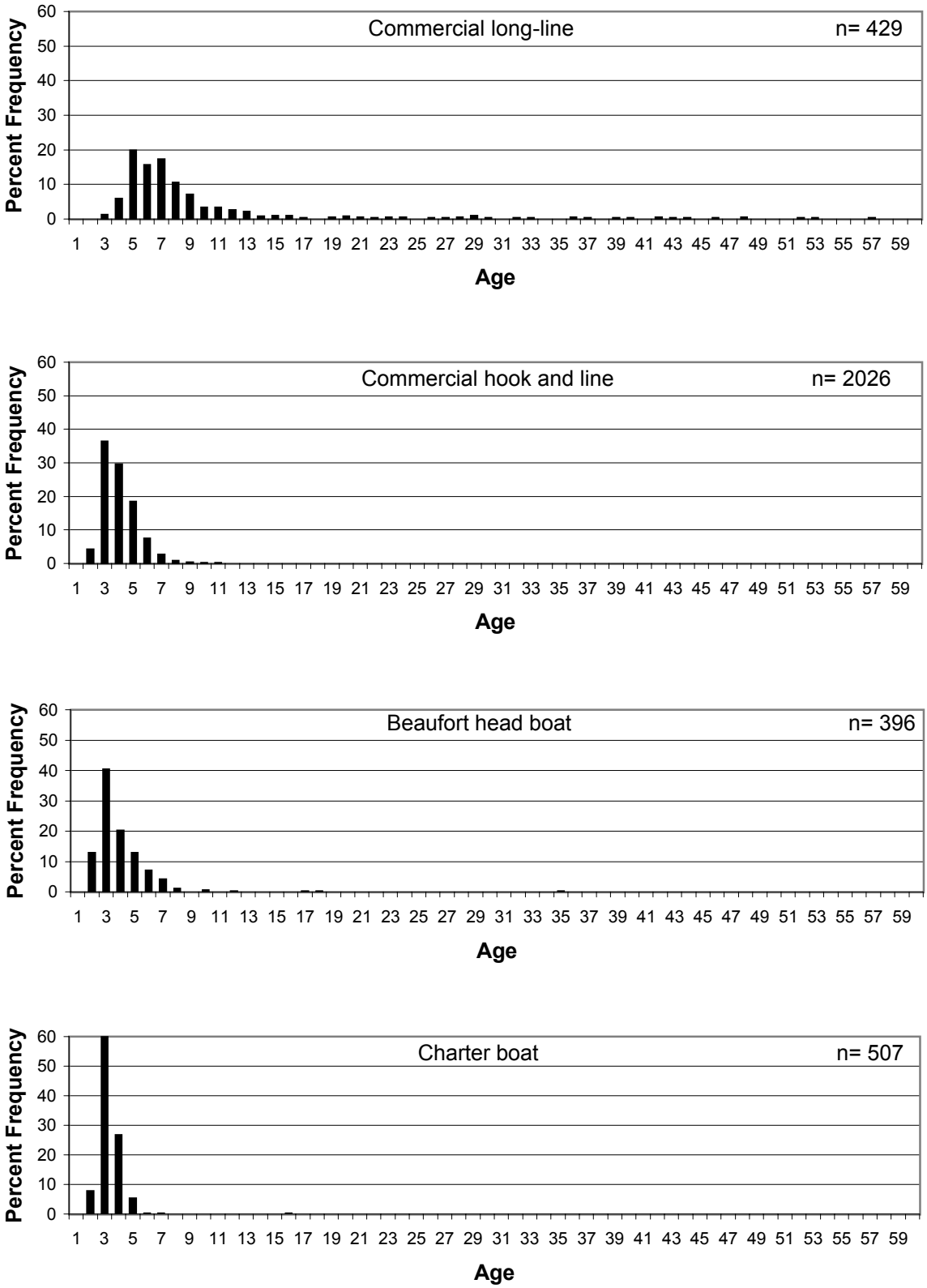


Figure 8. Age frequency distribution for red snapper from fishery independent surveys

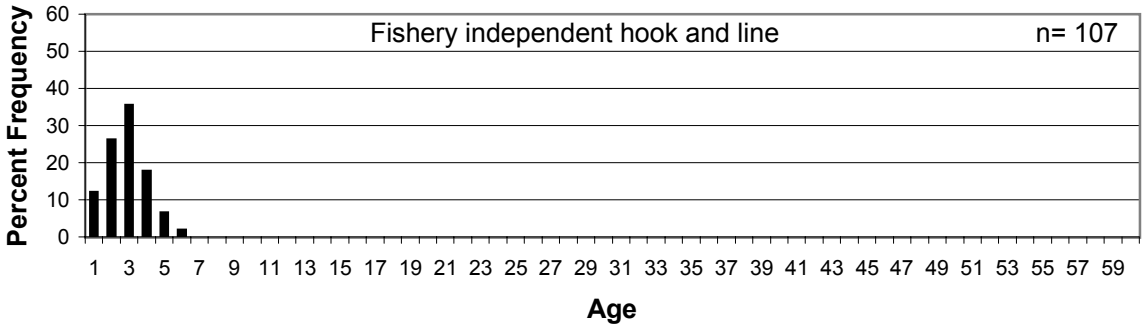
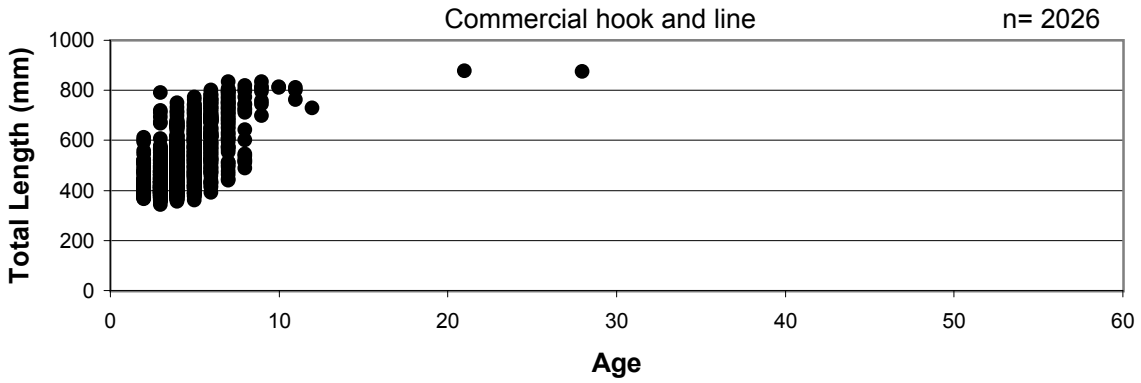
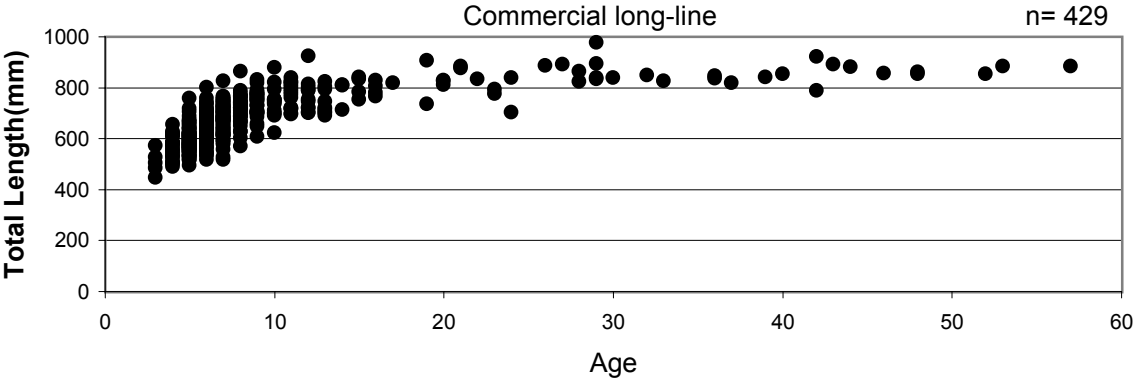


Figure 9. Size-at-age of red snapper based on otolith subsample.





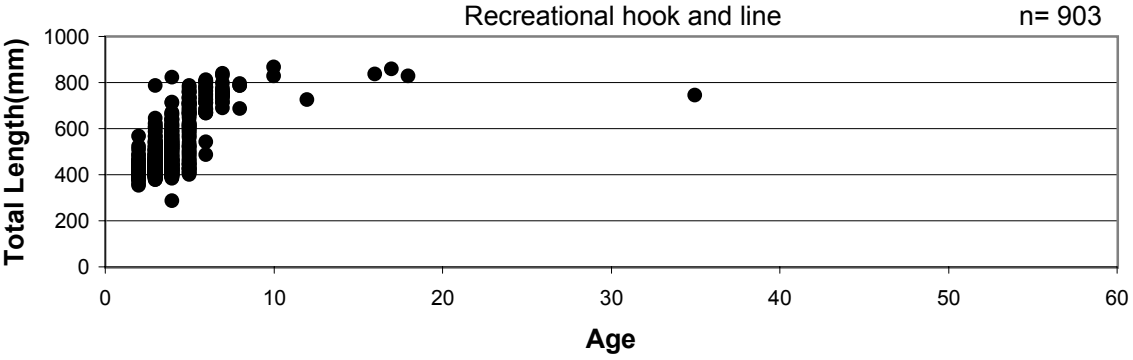


Figure 10. Size-at-age of red snapper based on otolith subsample.

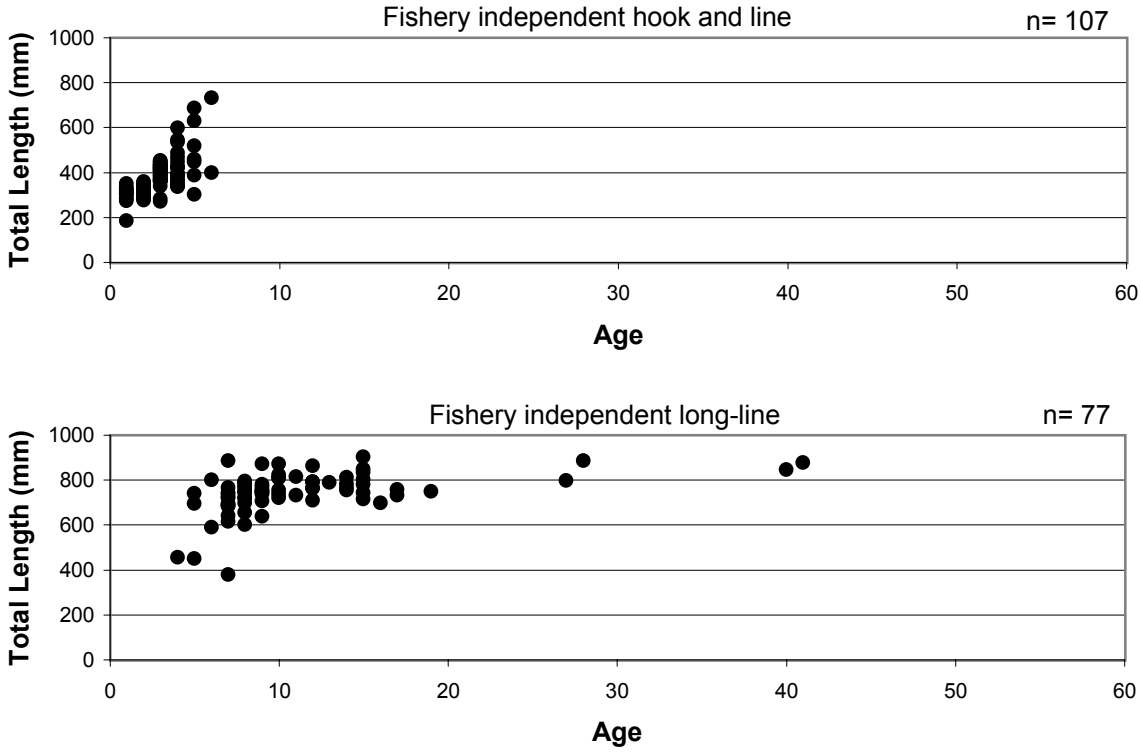
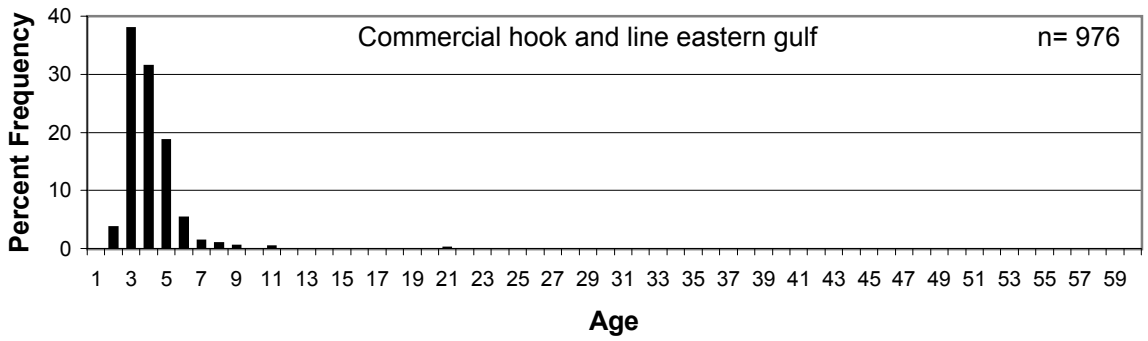
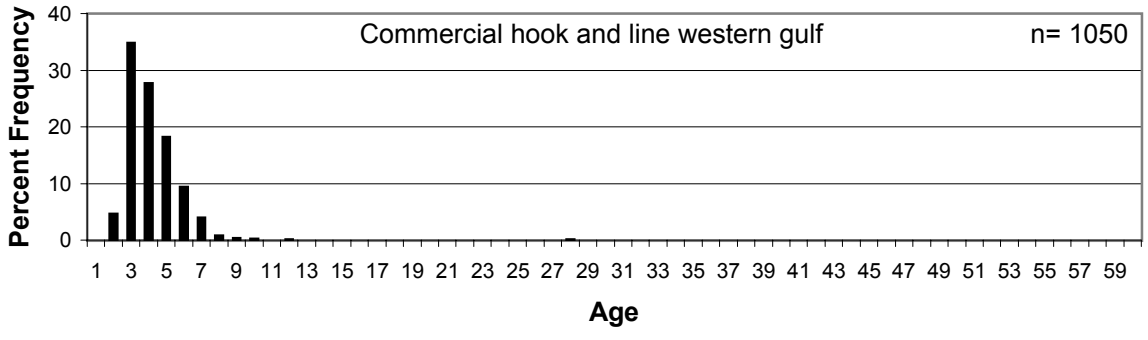
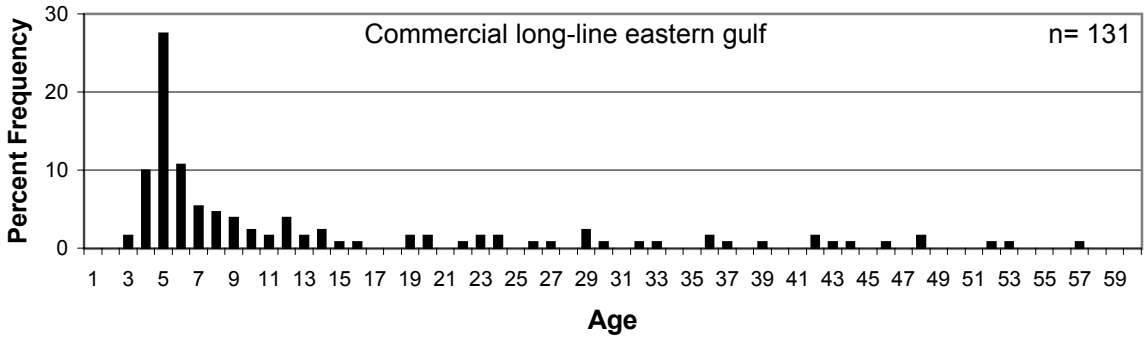


Figure 11. Age frequency distribution by region.







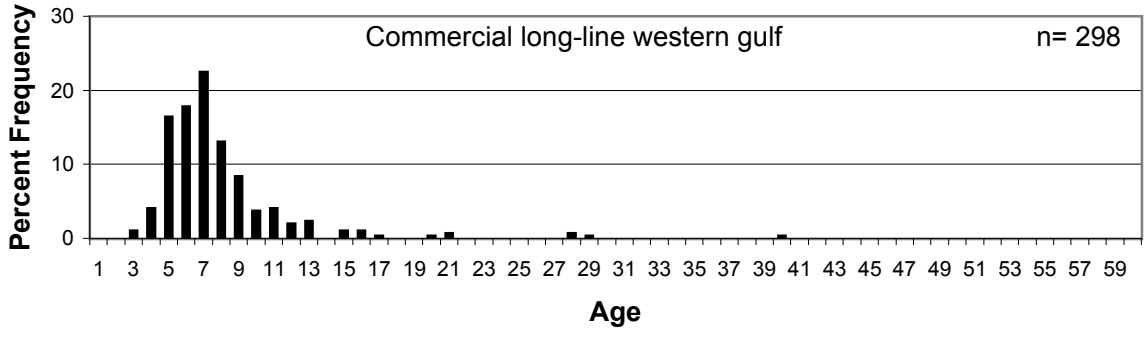


Figure 12. Age frequency distribution by region